NOTES ICHTYOLOGIQUES

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ASPECTS OF THE RED AND WHITE MYOTOMAL MUSCLE IN ARABIAN CARPET SHARK *CHILOSCYLLIUM ARABICUM* (GOUBANOV, 1979) FROM KHOR ABDULLAH, NORTHWEST OF THE ARABIAN GULF, IRAQ.

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Abstract. – The proportion of the myotomal muscle that comprises red muscle fibres was measured. The results are discussed in relation to their mode of life and swimming activity.

Résumé. – **Cette note étudie les proportions entr les muscles rouges et les muscles blancs chez le Requin-tapis. Les résultats sont discutés en fonction du comportement et de l'activité de la nage.**

The relative proportion of red muscle varies considerably between species of fishes (Kafuku 1950; Boddekke *et al.* 1959; Greer-Walker & Pull 1975; Bone 1978 & Al-Badri 1982) and between different body regions of the same individual (Fraser *et al.*, 1961; Mannan *et al.*, 1961 a, b,; Bone, 1966; Webb, 1970 and Al-Badri, 1982). In 84 species examined by Greer-Walker and Pull (1975), red muscle fibres never constituted more than a quarter of the total myotomal musculature, and in most, less than 10 %. Webb (1970) has shown that the mean value for the percentage of lateral line red muscle in the myotome at five positions along the body of the rainbow trout were 3.7 %, 1.8 %, 2.7 %, 3.5 %, and 8.1 % respectively and the mean for all five positions was 4.0 %. Mannan *et al.*, (1961 a, b) and Fraser *et al.*, (1961) found similar variation in other teleosts. However, in the sardine, *Sardinia melanosticta* red muscle accounts for as much as 48 % of the body weight (Kujikawa & Naganuma 1936).

The proportion of red muscle in the locomotor apparatus, has been shown to give some indication of the habits of the fish, and various workers have commented on this relationship (Boddeke *et al.*, 1959; Bone, 1966; Greer-Walker & Pull, 1975; Mosse & Hudson, 1977). For example, fish that have high cruising speeds tend to have relatively more red muscle. On the basis of a histological investigation on 21 species of freshwater teleosts, Boddeke *et al.*, (1959) concluded that the proportion of red muscle in the myotomes was related to the ability of a fish to sustain swimming activity and they have divided the fish into four categeories, namely; « sprinters » (e.g. Pike, Perch), « sneakers » (e.g. eel), « crawlers » (e.g. rudd, bream) and « stayers » (e.g. salmon, carp). The fish of the first two groups possess less red muscle in the myotome than the others. Thus, fish such as the salmonids and scombroids which are capable of relatively rapid sustained swimming, have correspondingly more red muscle than fish such as pike which are largely sedentary and show only occasional bursts of speed. Mosse & Hudson (1977) agreed with the earlier conclusions of Boddeke *et al.*, (1959) but stated that their divisions, while providing a useful scheme for classifying fish, are an over-simplification.

In some fish species, such as the chimaeroid *Hydrolagus affinis*, there is little red muscle in the myotome and locomotion at low speed is achievedby the action on enlarged pectoral fins (Dean 1906 and Kryvi & Totland 1978).

The present work is an attempt to evaluate the proportion of red and white muscle in Arabian carpet shark *C. arabicum* which was first described in 1979 by Goubanov and its description appeared in Goubanov & Shleib (1980).

Materials and Methods

Materials consisted of three specimens of Arabian carpet shark *C. arabicum* of which two were males and one female. The males varied in length from 57 to 62 cm. The female measured 60 cm in length. The material was collected in April 1983 from Khor Abdullah Northwest of the Arabian Gulf, Iraq.

Fresh transverse sections, approximately 1.5 - 2 cm thick from various regions along the length of the body were taken and photographed (Fig. 1). The photographs were projected onto tracing paper and the outlines of red and white muscle were traced. The tracings were then cut out and the various fractions weighed. The area of both types of muscle was expressed as a percentage of the total area of the section.

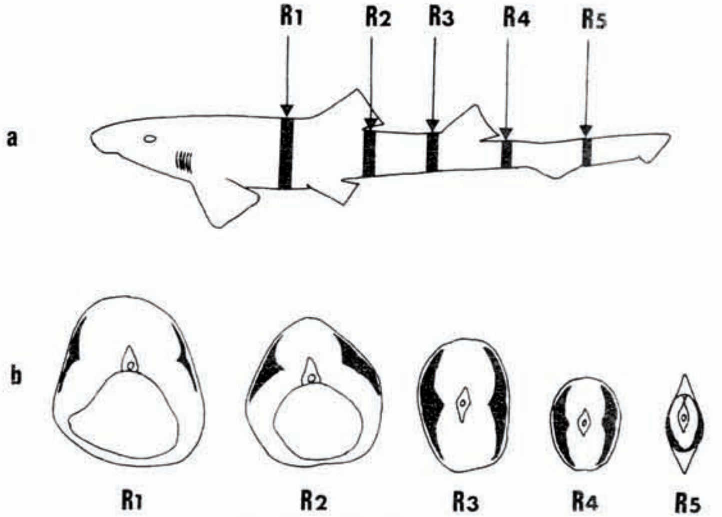

Fig. 1. a. Position of regions R_1 - R_5 in *C. arabicum*

b. Distribution of red and white muscle in regions R_1 - R_5. Red muscle, shaded area.

Results

Measurements of regional variation in the relative amounts of red and white muscle are shown in table I and Fig. 2 which reveal two major points :

- Firstly, the relative proportions of red and white muscle vary in all regions and the amount of white muscle is considerably greater than that of red one.
- Secondly, the relative proportion of red muscle increases toward the caudal fin.

There are some difficulties in comparing data given by different workers. For example, Greer-Walker and Pull (1975) examined the proportion of red and white fibres at a given level in different fish, whereas others have calculated the total amounts of the two types of fibres. In addition, it has been shown that the amount of red muscle may vary with environmental conditions such as temperature (Malessa, 1969; Wodtke, 1974; Love, 1980 and Broughton *et al.*, 1981). Broughton *et al.*, (1981) also stated that fish from a running water habitat contained significantly more red muscle than fish of the same age from still water. Consequently, in any comparison between species, a number of factors should be taken into account.

Table I

Relative proportion of red and white muscle in 2 males and 1 female *C. arabicum*. Numbers represent the mean.

Mean length (cm)		Region				
		1	2	3	4	5
59,66	Red muscle %	4.2	11.4	17.2	21.1	14.3
	White muscle %	95.8	88.6	82.8	78.9	85.7

In general, active fish have a relatively higher proportion of red muscle (Boddeke *et al.*, 1959; Greer-Walker and Pull, 1975; Mosse and Hudson, 1977). Love (1980) stated that the more time a fish spends in swimming, the more red muscle it possesses and certain very active species contain additional red muscle deep within the musculature. Bone (1966) and Al-Badri (1982) reported that the red muscle in the *S. canicula* is about 6 % of the mass of the myotome at the anterior end of the body and increases to around 20 % in the hinder region which is most active during swimming. Nag (1972), who found 15 % by weight of red muscle in the tail region of rainbow trout, considered the increase in red muscle towards

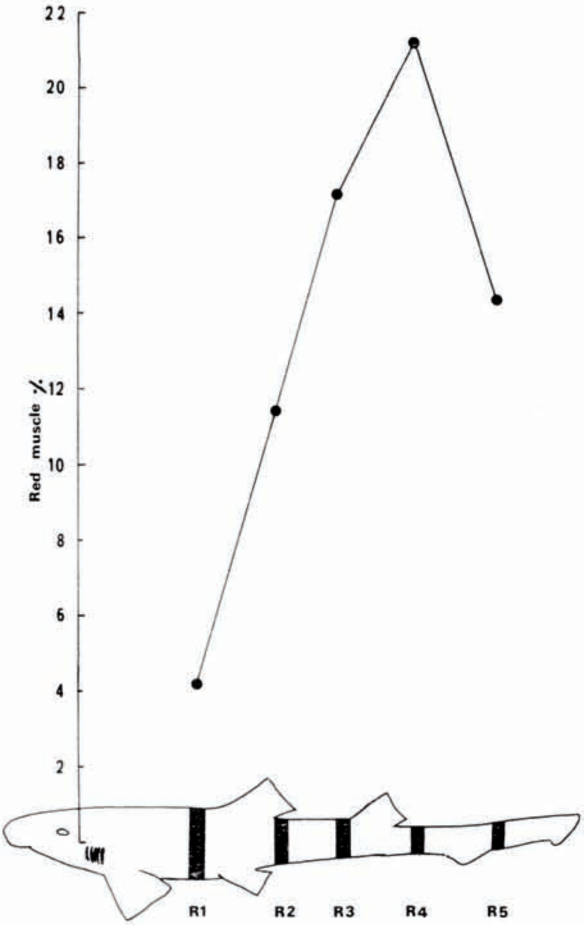

Fig. 2. Relationship between position and red muscle proportion. R_1 - R_5, regions.

the tail to be of importance in the mechanics of swimming, having regard to the concept that the caudal peduncle together with the caudal fin acts as « a main locomotory organ ».

One of the main features of results presented in this study was the higher percentage of red muscle towards the tail, presumably this related to the greater flexure of the body near the tail during swimming and the continuous energy requirement in this region is probably relatively higher than that of the rest of the body and it is probably mainly supplied by the red muscle fibres (Bone, 1966; Nag, 1972;, Love, 1980; Al-Badri 1982).

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A propos du complexe urophore de *Cheirodon pisciculus* (Girard) (Pisces, Characidae).

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Le complexe urophore des Poissons Téléostéens de la famille des Characidae semble très constant d'après Weitzman (1962), Roberts (1966, 1969) et Monod (1968). Il n'y a jamais de vertèbres urales individualisées, il y a une ou deux paires d'uroneuraux, deux ou trois épuraux et généralement six hypuraux, parfois cinq. Le nombre des rayons varie d'une espèce à l'autre et les rayons non articulés ne sont jamais très nombreux. *Cheirodon pisciculus* présente la plupart de ces particularités : il a trois épuraux, six hypuraux et un uroneural (fig. 1). La neuracanthe de la deuxième vertèbre préurale est très courte.

C'est au niveau des rayons non articulés que *Cheirodon pisciculus* est original : en effet, si le nombre des rayons dorsaux, bien qu'élevé, n'est pas excessif, les rayons ventraux non articulés sont par contre très nombreux et parfois fourchus. Ils s'étalent jusqu'au voisinage immé-